

Grade 7



KOLOA, MALLARD OR BOTH -- *Which is it?*

Focus Questions: How can we tell apart the Koloa maoli, Mallards and hybrids? Why might it be important to be able to do that?

Lesson at a Glance: Students will use visual clues to determine the differences between Koloa maoli and Mallards using photos and worksheets. They will learn about hybridization of ducks in Hawai'i and research examples from other places that are facing similar problems. Students then create materials to communicate their solutions to the problem of Koloa hybridization.

Key Concepts

- Koloa maoli is an endangered species found nowhere else in the world.
- Feral Mallards are considered an invasive species in Hawai'i.
- Koloa maoli and Mallards are closely related ducks that can interbreed and produce fertile offspring.
- Interbred ducks are called hybrids that can display traits of both parents.
- Distinguishing between a Mallard and hybrid versus a Koloa maoli is important to save this endangered species.

Objectives: Students will be able to:

- Identify parts of a duck's body using scientific terms.
- Identify characteristics, including body colors, that distinguish between Koloa maoli and Mallard ducks (male and female).
- Define the terms: hybridization, invasive species, feral, extinction.
- Explain why feral Mallards are threats to the Koloa maoli.
- Using the Internet, research examples of duck hybridization in other places such as Oceania, and explain what others are doing about it.
- Create a solution to the hybridization issue and communicate it effectively to others.

Subject Areas

science, language arts, art, social studies

Time: two to three class periods

Materials

- Videos and photos of Koloa maoli (provided)
- "Koloa or Mallard" worksheet (provided)
- "Koloa or Mallard" answer sheet (provided)
- White board
- Color pencils or pens

- Poster making supplies
- Computer with Internet connection

Standards and Benchmarks

Science Standard 1: The Scientific Process: SCIENTIFIC INVESTIGATION

Topic: Scientific Inquiry

Benchmark: SC.5.1.2: Formulate and defend conclusions based on evidence

Science Standard 2: The Scientific Process: NATURE OF SCIENCE: Understand that science, technology, and society are interrelated

Topic: Science, Technology, and Society

Benchmark: SC.7.2.1: Explain the use of reliable print and electronic sources to provide scientific information and evidence

Science Standard 4: Life and Environmental Sciences: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically

Topic: Classification

Benchmark: SC.7.4.4: Classify organisms according to their degree of relatedness

Science Standard 5: Life and Environmental Sciences: DIVERSITY, GENETICS, AND EVOLUTION: Understand genetics and biological evolution and their impact on the unity and diversity of organisms

Topic: Unity and Diversity

Benchmark: SC.7.5.6: Explain why variation(s) in a species' gene pool contributes to its survival in a constantly changing environment

Social Studies Standard 7: Geography: WORLD IN SPATIAL TERMS-Use geographic representations to organize, analyze, and present information on people, places, and environments and understand the nature and interaction of geographic regions and societies around the world

Topic: World in Spatial Terms

Benchmark: SS.7PI.7.1: Use geographic representations such as maps or models to explain population distribution and the physical and human characteristics of places in Oceania, including landforms, natural resources, climate, river, lakes, bridges, dams, roads, and buildings

Teacher Background Information

The Koloa maoli is also known as the Hawaiian duck. (Koloa = duck, maoli = native) is one of Hawaii's two native ducks (the other is the Laysan duck, found only in the Northwestern Hawaiian Islands). Unfortunately, the number of Koloa maoli is very low and it is in danger of extinction.

Koloa maoli adult males (drakes) and females (hens) are overall colored mottled brown. Males usually have darker heads and necks, more greenish-yellow tones in their bills and brighter orange feet than females. Females have dark bills with orange markings and they are smaller than males. Both sexes have iridescent green to blue-green wing feathers (speculum) edged with white that are sometimes visible as a patch on their sides.



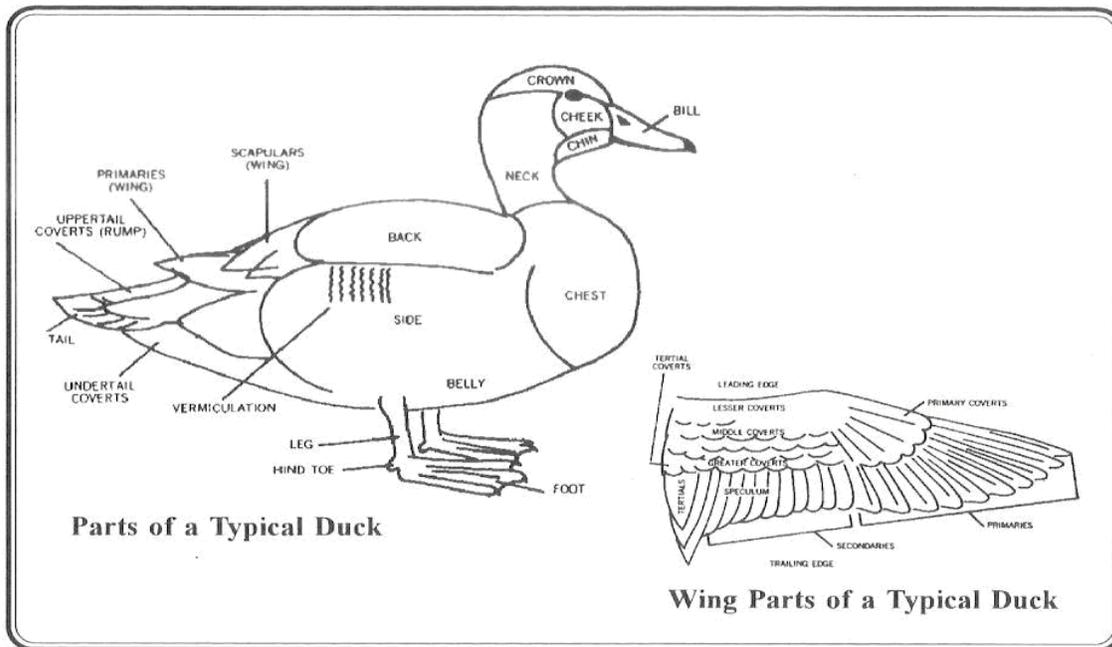
The Mallard is closely related to the Koloa maoli. The male Mallard (in breeding season) has the distinctive green head, white neckband, and yellow bill. Its chest is chestnut-colored and body is gray with a black rump. Females are mottled drab brown with orange bills. Both sexes have iridescent purple-blue wing feathers (speculum) edged with white. During the late summer and fall, some male Mallards molt and look like female Mallards.



Feral ducks, mainly Mallards, photo by David Preston

When comparing a Koloa maoli and Mallard side by side, one would see that the Koloa is a deeper, richer brown, and about 20 to 30% smaller than the Mallard. The behaviors are also different. The Koloa maoli is usually “shy” and “secretive” whereas the Mallard is more “bold” and “aggressive.”

See Table 1 for summary of major differences in appearance.



Source: Utah Project Wild

Table 1: Major differences in appearance between Koloa maoli and Mallards

	Male Koloa	Female Koloa	Male Mallard*	Female Mallard
Head color	Brown or dark brown	Brown	Green	Brown
Chest	Mottled brown	Mottled brown	Chestnut	Mottled brown
Back	Brown with lighter markings	Brown with lighter markings	Gray	Brown with lighter markings
Speculum	Green to blue-green	Green to blue-green	Blue to purple	Blue to purple
Bill	Greenish-yellow to dark	Dark with orange markings	Yellow or yellow-green	Orange with dark markings
Undertail coverts	Mottled brown	Mottled brown	Black	Mostly white
Belly	Mottled brown	Mottled brown	Gray	Mottled brown
Size	Small	Very small	Large	Larger than male Koloa

*Breeding plumage (feathering or appearance during the breeding season only).
Mottled = brown with lighter blotches, streaks, or spots; brown and tan marbled appearance.

Koloa maoli are unique to Hawai'i, found only in the main Hawaiian Islands. In contrast, Mallards are native in North America, Europe, and Asia. It has been introduced by humans to New Zealand, Australia, Africa, and Hawai'i. Scientists believe that Mallards were brought to Hawai'i starting in the late 1800s for stocking ornamental ponds and farming. In the 1950s and 1960s they were brought in by the hundreds for sport hunting. Few Mallards are migratory and come to Hawai'i on their own but they are here during their non-breeding season (November through March) and are not believed to pose a threat to Koloa.

Domesticated Mallards that have been released or escaped into the wild and are reproducing are called "feral." Feral Mallards are dominant ducks, adapted to survive and reproduce in habitats with human influences, giving them the competitive edge over Koloa maoli. Large concentrations of feral ducks in parks near dining establishments are a potential human health hazard.

Currently, the most serious threat to the Koloa maoli is hybridization with feral Mallards. Hybridization is when two closely related species reproduce to create a crossbreed. This is a problem for the Koloa maoli, because their gene pool is diminishing. The species could become extinct because of hybridization alone in a relatively short period of time.

Mallard/Koloa hybrids are often difficult to distinguish from Koloa because the size and plumage (feathers) of hybrids can vary greatly. Even biologists have trouble! To help with this problem, scientists are developing techniques to more accurately differentiate duck types.



While it may seem appropriate to use the analogy of mixed races of people to hybrid ducks, that is incorrect. All human races are of the same species (*Homo sapiens*). The Koloa maoli (*Anas wyvilliana*) and Mallards (*Anas platyrhynchos*) are completely separate species. They are in the same genus (*Anas*) and are related closely enough to breed and

create offspring that are fertile. Some hybrids, like the mule (cross of a female horse and male donkey) are infertile. Outside of rare cases, mules cannot make more mules. Koloa and Mallards were reproductively isolated until people brought Mallards to Hawai'i.

Resident wild ducks on O‘ahu and Maui are predominantly Mallard/Koloa hybrids, but true Koloa populations are believed to still occur on Kaua‘i, Ni‘ihau and Hawai‘i in wetlands *mauka* to *makai*. However, recent genetic studies show that hybrids now occur on Kauai and Hawai‘i, worsening the problem. Twenty year trends on O‘ahu show a rapid increase in Mallard-hybrid observations and an equally rapid decrease in Koloa observations.

Feral Mallards are not only problematic in Hawai‘i. They threaten native duck populations around the world. (See Table 2 below.)

Table 2: Native ducks threatened (or potentially threatened) by feral mallards

Species	Location
African Black Duck	Southeast Africa
American Black Duck	Eastern North America
Mottled Duck (aka Florida Duck)	Southeastern U.S.
Laysan Duck	Laysan and Midway, Northwestern Hawaiian Islands
Mexican Duck (almost extinct)	Southwestern North America
New Zealand Grey Duck (almost extinct)	New Zealand
Australian Black Duck	Australia
Eastern Spot-billed Duck	Russian Far East
Yellow-billed Duck	Southeast Africa
Meller’s Duck	Madagascar, Mauritius

Source: Hawai‘i Conservation Alliance Koloa-Mallard Hybridization Position Paper

Feral duck control programs in other regions have made significant strides. In Florida, for example, feral Mallards threaten the native Mottled Duck and wildlife officials are able to enforce strict laws prohibiting possession and sale of Mallards.

If feral Mallards are removed from Hawai‘i, our islands’ isolation may provide natural barriers for reinvasion. Therefore, scientists believe that the Koloa maoli has a high potential for recovering from being endangered but only if we act now.

Teaching Suggestions

Preparation:

Duplicate the worksheet and select photos from the CD.

Part One

- 1) Ask students if they have ever seen a wild duck in Hawai'i. Have them explain where they have seen these birds and what they looked like. What kinds of ducks do they think they were?
- 2) Introduce the names "Koloa maoli" and "Mallard" and explain that both ducks are found in Hawai'i. The Koloa maoli is a native species found only in Hawai'i. Most Mallards were brought here by people. Show a few pictures of Koloa maoli and Mallards using the CD provided.
- 3) Go over the main body parts of a duck by drawing the diagram (in teacher background section – wing parts not necessary) on a white board or projecting it on a screen.
- 4) Pass out the worksheet to each student. Explain that they will note the physical features of the Koloa maoli and Mallard (e.g. color of bill, chest, feet) on the worksheet as they review images of the birds and listen to your descriptions. Repeat showing the pictures or have students search on the Internet for photos and descriptions.
- 5) Divide the students into pairs and have them review their worksheets together before going over the answers as a class. For extra points, they could color their worksheets as accurately as possible.

Part Two

- 1) Now introduce the concept of hybridization of birds. Koloa maoli and Mallards are closely related species. They can breed and produce offspring (hybrids) that can make even more hybrids.
- 2) Show the three short videos (provided). Ask students to listen for what is said about the Koloa maoli and why hybridization with feral Mallards is a problem. They should also listen for ways to address the problem.
- 3) Explain that it is sometimes very hard to tell between Koloa maoli and hybrids. Without the distinctive green head of the male Mallard, the hybrids sometimes look very much like the Koloa maoli except the Mallards are bigger. The feral Mallards usually but not always behave more aggressively than the Koloa maoli that are described as "shy."
- 4) Ask students why it is a problem for scientists and resource managers that Koloa maoli and hybrids look alike. (It could be hard to tell if the population is becoming hybridized. And it would be difficult to know which birds to remove. The good news is that scientists are coming up with reliable tools to figure out how to tell the difference.)

- 5) Divide students into teams of 3 or 4 and ask them to come up with ideas that would help solve the problem of Mallard/Koloa hybridization in Hawai'i. Have them use the Internet and other sources to research this issue in other places like Florida, New Zealand, Australia and the Northwestern Hawaiian Islands. Encourage them to express their ideas in the form of maps, news articles, posters, or presentations.
- 6) Have students present their ideas to the class. Encourage them to share their best ideas with wildlife officials (see the resources section below for contact information.)

Assessment:

You could assess students by:

- completion of the worksheet and participation in discussions.
- effectiveness in working in teams.
- thoroughness of research for their subject (e.g. diversity of sources, effort)
- content and quality of their projects (e.g. accuracy of facts, creativity, expression)
- effectiveness in communicating their projects

Extended Activities

- If you are able to take your class on field trips, visit a wetland on your island and find Koloa maoli, Mallards, and hybrids. See if your students can recall the body parts of the ducks and key identifying features. Listed below are some lowland wetland areas on various islands where one may see native waterbirds; some sites are more accessible than others. Please contact the landowners/managers for permission to enter. A few of these sites offer guided tours or volunteer work projects.

Kaua'i –

- Hanalei National Wildlife Refuge – www.fws.gov/hanalei/
- Hulē'ia National Wildlife Refuge – (see from Menehune Pond Overlook) www.fws.gov/huleia/
- National Tropical Botanical Gardens (Lāwa'i and Limahuli Gardens) – ntbg.org/gardens/

O'ahu –

- James Campbell National Wildlife Refuge – www.fws.gov/jamescampbell/
- Ka'elepulu Wetland – kaelepuluwetland.com/
- Kawainui and Hamakua Marsh Wildlife Sanctuaries – contact State Division of Forestry & Wildlife at 808.973.9787; kawainuimarsh.com/Site%20Folder/index.html; hamakuamarsh.com/

- Marine Corps Base Hawai'i (Nu'upia Ponds Wildlife Management Area) – contact Environmental Compliance & Protection Department, 808.257.6920 ext 224
- Pearl Harbor National Wildlife Refuge (Honouliuli unit) – <http://www.fws.gov/pearlharbor/>; contact Hawai'i Nature Center at 808,955.0100; www.hawaiinaturecenter.org
- Pouhala Marsh Wildlife Sanctuary – <http://search.volunteerhawaii.org/org/opp/24532223.html>
- Waimea Valley – waimeavalley.net

Maui –

- Kanahā Pond Wildlife Sanctuary – kiosk for bird watching; open to public
- Keālia Pond National Wildlife Refuge – www.fws.gov/kealiapond/
- Mākena State Park – hawaii.stateparks.org/parks/maui/index.cfm?park_id=38
- Waihe'e Refuge – mauicoastallandtrust.org/

Moloka'i –

- Kakahai'a National Wildlife Refuge – <http://www.fws.gov/kakahaia/>

Hawai'i -

- Kaloko-Honokōhau National Historical Park ('Aimakapā Fishpond, Kaloko Fishpond, anchialine ponds) – nps.gov/kaho/
- Loko Waka Ponds (Hilo) and 'Ōpae'ula Pond (Makalawena, North Kona)– contact Kamehameha Schools Land Assets Division at 808.322.5300
- Waipi'o Valley – view from overlook (free)

See the *Hawai'i Wildlife Viewing Guide* by Jeanne L. Clark for more information. (Produced by Watchable Wildlife Inc., Adventure Publications, Inc. 2006.)

Resources

- State Department of Land and Natural Resources, Division of Forestry and Wildlife offices:
808.274.3433 – Līhu'e, Kaua'i
808,587.0166 – Honolulu, O'ahu
808.984.8100 – Wailuku, Maui
808.887.6061 – Waimea, Hawai'i
808.974.4229 – Hilo, Hawai'i
- The Feral Mallard Threat to Hawaii's Native Duck: Recommendations for Preventing the Extinction of the Endangered Koloa Maoli, position paper, September 2008, Hawai'i Conservation Alliance.
<http://hawaiiconservation.org/koloa.asp>

- Hawaiian Duck's Future Threatened by Feral Mallards, fact sheet by U.S. Geological Survey Pacific Island Ecosystems Research Center.
<http://pubs.usgs.gov/fs/2007/3047/>
- Hawai'i State Waterbird Count – Photographic Identification Guide by Eric A. VanderWerf, June 2005